Pradel's model of a recruitment/popn. growth rate parameterization

Disappearance rate:

$$P_s(h) = \left\{\prod_{i=e}^{\ell-1} \phi_i\right\}\left\{\prod_{i=e+1}^{\ell} p_i^{\varepsilon_i}(1-p_i)^{1-\varepsilon_i}\right\}\chi_\ell$$

where

$e \equiv$ earliest observation in capture history
$\ell \equiv$ last observation in capture history
$\epsilon_i \equiv$ indicator (1-capture, 0-noncapture)
$\chi_i \equiv$ probability of not being seen after occasion *i*

Appearance rate: (a capture history read backward) [Recruitment analysis]

$$P_r(h) = \left\{\prod_{i=e+1}^{\ell} \gamma_i\right\}\left\{\prod_{i=e}^{\ell-1} r_i^{\varepsilon_i}(1-r_i)^{1-\varepsilon_i}\right\}\xi_e$$

where

$\gamma_i \equiv$ seniority: probability that an animal present at *i* was already present at *i-1*
$\xi_i \equiv$ probability of not being seen before time *i*

Computing time-specific population growth rate (PGR):

λ to population biologists, ρ to Pradel

How many individuals present at (just after) *i* are present in the population at (just before) *i+1*?

Survival context: $N_i^+\phi_i$

Recruitment context: $N_{i+1}^-\gamma_{i+1}$

So

$$\lambda = N_i^+\phi_i = N_{i+1}^-\gamma_{i+1}$$

Therefore

$$\frac{N_{i+1}^-\gamma_{i+1}}{N_i^+} = \phi_i$$

$$\frac{N_{i+1}^-}{N_i^+} = \frac{\phi_i}{\gamma_{i+1}}$$